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Sint autem A B & C D in diversis Planis, ita tamen ut E G pro-nŭta, sit ad rectos angulos utrique A B & C D: accedant denique ad se invicem Corpora, prout opus fuerit, servata tamen eadem inclinatione & situ Axium.

Dico, ex revolutione & mutua attritione Corporum prius positorum exurgere nova corpora Geometrica, quorum P & Q erunt Cylindroidea Hyperbolica aequalia, R. vero Conoides Hyperbolicum, specie & magnitudine datum.

Demonstrationem in promptu habemus, nec non Modulum ipsius Machina, terendis Lentibus Hyperbolicis destinata; quam operosa pictura & proluxa explicatione describere, mihi & artifice magis fuerit molestum, quam Dædalo cuiusvis sagaci similem ad-invenire. Postquam enim exposita jam sunt principia Geometrica, facile erit conjicere, quale sit Instrumentum; nempe, tres sunt Tabulae oblongae, planae, validae, labiles, & sibi invicem impositae: Infima & Media sustinent inaequalia Capitula (sive Anfas mamphur sustinentes) alternatim posita; id postulat utriusque mamphuris obliquitas & quasi decussatio: Summa Tabula aequalia sunt Capitula in longum Tabula disposita; & perforato citimo Capitulo mamphur transmittitur. Omitto rotas, rotulas, lora, pondera, cochleas, & reliqua ad motum expeditum & Machinae firmitu linem necessaria. P pertinet ad infimam Tabulam; Q ad mediam; R, ad summam. R, Lens est vitrea: Q, Modulus Lentem terens; P, Formula Modulum corrigens; quae, dum motu obliquo, & diverso a motu tam Lentis quam Moduli, fertur, delet continuo & deterrit, quicquid vitii imprimitur in Modulum ex Lentis & Materia attritione.

Quare, cum ad o simplex & spontanea sit ista Hyperbolici Conoidis genitura, ex solis nempe motibus Circularibus; cumque motus sit duplex & varius, credibile est, Lentem Hyperbolicam ex hisce Principiis vel nullis fore explicandas.

Some Inquiries Concerning the Salt-Springs and the Way of Salt-making at Nantwich in Cheshire; Answer'd by the Learned and Observing William Jackson Dr. of Physick.

1. **W**Hat is the depth of the Salt-springs? The depths are various, in some places not above 3. or 4. yards. In our Town of Nantwich, the Pitt is full 7. yards from the

the footing about the Pitt; which is guessed to be the natural height of the Ground, though the Bank be 6. foot higher, accidentally raised by rubbish of long making Salt, or *Walling*, as they call it, In other places the Springs lye much shallower; for in two places within our Township the Springs break up so in the Meadows, as to frett away not only the grafs, but part of the earth, which lyes like a breach, at least halfe a foot or more lower than the turfe of the Meadow, and hath a Salt liquor, oufing, as it were, out of the mudd, but very gently.

2. *What kind of Country 'tis thereabout, where the Springs are, whither Hilly &c.; And what Plants grow near them?* Our Country is generally a low ground, witness the name given to it (*the Vale Royal of England*;) yet 'tis very full of Collicular Eminencies, and various Risings, to distinguish it from being all Meadow. We have also a peculiar sort of ground in this County and some adjacent parts, which we call *Mosses*; and they are a kind of Moorish boggy ground, very stringy, and fatt: which serveth us very well for Turfs, cutt out like great Bricks and dried in the Sun. And this kind of ground is so much here, that there are few Townships but they have their particular Mosses. In these is found much of that Wood we call *Firr-wood*, which serves the Country-people for Candles, Fewel, and sometimes for small Timber-vses; and this the Vulgar concludes to have layn there since the Flood. But generally these Mosses seem to be places undermined by some Subterraneous streams; or by the dissolution of some matter, that made them equal with the rest of the ground formerly: In which conjecture I am confirmed by this, That near a place of My Lord *Cholmondeley's*, called *Bilkely*, about 9. or 10. years since, not far from one of these Mosses, without any Earth-quake, fell in, a piece of ground about 30. yards over, with an huge noise, and great Oakes growing on it fell with it together; which hung first with part of their heads out, afterwards suddenly sunck down into the grounds, so as to become invifible: Out of which Pitt they drew Brine with a pitcher tyed to a cart-rope, but could then find no bottom with the ropes they had there: Since, the Pitt is filled up with water, and now doth not taste Salt, but a very little brackish, a very small rindlet passing through it. The

nearest Salt-springs to this place are at *Dartwich* about 3. miles from it, belonging to the present Lord *Keeper*, and My Lord *Cholmondeley*.

Some *Hills* we have, but no bigg ones, near our Springs; which generally lye all along the River *Weever*, as *Hankilow*, *Hatherton*, *Osterfon*, *Bartherton*, *Nantwich*, *Weever*, *Leftwich*, *Northwich*; yet there is an appearance of the same Veine at *Midlewich* nearer the River *Dane*, than *Weever*; which notwithstanding seems not to be out of the Line of the *Weeverish* streame; and these lye all near Brooks, and in Medowish grounds.

As to *Plants*, I could observe no singularity at all; for, where the Salt reaches the surface, it frets away all (as I said before,) and upon the Turfe near the old decayed Pitts grows the very same, that doth in the remotest place of the Meadow; only I observe, that, where the Turff was fretted away, *Rushes* maintain'd their station longest; yet they grow also in other moist grounds, so that they are no friends to the Salt-springs, but I perceive, they resist them best.

3. *Whether there be any Hot-springs near the Salt-ones? And Whether the Water of the Salt-springs be hotter or cooler, than other Spring-water?* The Water of the Salt-springs here is very cold at the bottom of the Pitt, insomuch that when the Briners sometimes goe about to cleanse the Pitt, they cannot abide in, above half an hour, and in that time they drink much Strong water.

There is not any Hot Springs (that I can hear of) nearer us, than *Buckston-well*, which is about 30. miles distant near *Darby-Peak Hills*.

4. *Whether they find any Shells about those Springs, and what kind of Earth it is?* I cannot hear of any Shells digged up, though of late several new Brine-springs have been both sought, and found by sinking deep Pitts; yet none knows of any Shells, but rather a blackish Slutch mixt with the Sand, which infects the whole Spring (like the Scuttle-fish) black, when 'tis stir'd; else the water runs very clear.

5. *How strong the Water is of Salt?* Springs are rich or poore in a double fence; for a Spring may be rich in Salt, but poor in the quantity

quantity of Brine it affords. Thus they have a rich Brine in their chief Pit at *Middle-wich*, which yields a full *fourth* part of Salt, like the rich *Burgundian* Springs, mentioned in *Kircher's Mundus Subterraneus*; yet this is so thrifty of its Brine, that the Inhabitants are limited to their proportions out of it, and their quantity is supply'd out of Pits that afford a weaker Brine. Our Pitt at *Nantwich* yields but a *sixth* part; but then 'tis so plentiful a Spring, that, whereas they seldom *Wall*, that is, make Salt, in above 6. Houses at a time, and there are or should be about 50. Wich-houses in the Town; this Pitt is Judged sufficient to supply them all: And this advantage would accrew over and above, that such quick Use of the Pitt extremely strengthens the Brine, perhaps to a degree little less than that of *Middle-wich* Pitt: For, I have tryed it myself, that a quart of Brine, when the Pitt hath been drawn off 3. or 4. days first, to supply 5. or 6. Wich-houses, hath yielded an Ounce and an halfe more of Salt, than at another time, when it hath had a rest of a week or thereabout. But I conclude, that the nearest conjecture, to be made of the strength of this Brine, is, to yield *one* pound of Salt for *six* pounds of Brine; as I have severall times tryed without any operation that might obscure the working: By which proportion you see, that *six* Tuns of Brine yield *one* tun of Salt: which may be built upon; though in their ordinary way of working they make such variety of Additions, that 'tis impossible for any to be confident of the Product.

To adde some particulars, concerning this point; I shall tell you, that *March* 8. 1668. I weighed *two* pounds of distilled water in a narrow-mouthed Glasse-bott'e, that I might make an exact marke for a quart. This Bottle, being fill'd with our Brine to the very same mark, weigh'd (besides the tare of the Bottle) *two* pounds *three* ounces and *five* drachmes. This was taken up, when the Wich-houses but began to work, so that the Pitt was but little drawn. I fill'd up the Bottle with the same Brine, and it weighed just three drachms more. This Brine, boyled away without any addition or clarification, made *five* ounces and *two* drachmes of Salt. Five days after, when the Pitt had been drawn all that while for the working of the Wich-houses, vid. *March* 13, the same Bottle, fill'd to the Quart-mark
 afore-

aforesaid with Brine *then* taken up, weighed, beside the Bottle, *two pound four ounces and one drachme*: the same time the Bottle, filled as in the former Experiment, weighed *just two pounds and an half*, which is three drachms more than the quart mark before; which boyl'd into Salt made *six ounces six drachms and two scruples*: which exceeds the former quantity of Salt, *one ounce four drachms and two scruples*, though the Brine exceeded the former in weight but *four drachms*.

By which Tryall I confuted also a Tradition, which the Briners have amongst them, *viz.* That the Brine is strongest at times of the Spring-Tydes, to wit, at the Full and Change of the Moon. For *March 8th.* aforesaid was only one day past the Full, and then the Brine was weaker than it was the *13th* day, when 'twas 6. days past the Full. So that I conclude, there could be no other reason, than that the much drawing makes way for the Salt-springs to come the quicker, and allows the less time for the admission of Fresh Springs.

6. *What is the Manner of their Work? or What Time of boyling the Salt-water? Whether they use any peculiar thing to make it granulate, and if so, What that is?* Their manner of working is this: They have formerly boyl'd their Brine in 6. Leaden pans with wood-fire; upon which accompt they all claime their interest in the Pitt by the name of so many *Six Leads Walling*; by which they each know their proportion; but in the memory of many alive they changed their 6. Leads into 4 Iron-pans, something better than a yard square, and about 6. inches deep, still fitting the Content of these to that of the 6. Leads: and of late many have changed the 4 Iron-pans into two greater; and some *Wall* but in one. But still the Rulers gage it to their Old proportions. Thus much seem'd necessary for understanding the several Operations.

They use for their Fewell, Pit-coals, brought out of *Staffordshire*. These Panns are set upon Iron-barrs, and made in, on all sides, very close (that the flame nor smoak break through) with clay and bricks. They first fill their Pans with Brine out of the Pitt; which comes to them in several Woodden Gutters: then they put into their Panns amongst their Brine a certain mixture, made of about 20. Gallons of Brine, and 2. quarts of Calves Cows and chiefly Sheeps bloud, mixt into a Clarret-Colour: Of
this

this mixture they put about 2. quarts into a Pann that holds about 360. quarts of Brine; - this bloody brine, at the first boyling of the Pann, brings up a scum, which they are careful to take off with a Skimmer, made with a wooden handle thrust through a long square of Wainscot-board, twice as bigg as a good square trencher: this they call a *Loot*. Here they continue their fire as quick as they can, till halfe the Brine be wasted, and this they call *Boyling upon the fresh*. But when 'tis halfe boyled away, they fill their Panns again with new Brine out of the *Ship*, (so they call a great Cistern by their Panns sides, into which their Brine runs through the Wooden Gutters from the Pump, that stands in the Pitt;) then they put into the Pann, 2. quarts of the Mixture following: They take a quart of Whites of Eggs, beat them thoroughly with as much Brine, till they are well broken; then mix them with 20. Gallons of brine, as before was done with the Bloud; and thus that which they call the *Whites* is made. As soon as this is in, they boyle sharply, till the second Scum arise; then they scum it off as before, and boyle very gently till it Corne; to procure which, when part of the Brine is wasted, they put into each Pann of the Content aforesaid about a quarter of a pint of the best and strongest Ale they can gett: this makes a momentary Ebullition, which is soon over, and then they abate their fires, yet not so but that they keep it boyling all over, though gently; for the Workmen say, that if they boyle fast here, (which they call *Boyling on the Leach*, because they usually all this time lade in their Leach-brine, which is such Brine, as runs from their salt, when 'tis taken up before it hardens) if I say, they boyle fast here, it wasts their Salt. After all their Leach-Brine is in, they boyle gently, till a kind of Scum come on it like a thin Ice; which is the first appearance of the Salt: then that sinks, and the Brine every where gathers into Cornes at the bottom to it, which they gently rake together with their *Loots*: I say, *gently*; for much stirring breakes the Corne. So they continue, till there is but very little brine left in the Pann; then with their *Loots* they take it up the Brine dropping from it and throw it into their *Barrows*, which are Cases made with flat cleft wickers, in the shape almost of a Sugar-loaf, the bottom upper-most. When the Barrow is full, they let it stand so for an hour and an halfe in the Trough, where

where it drains out all the Leach-brine aboveſaid, then they remove it into their Hot-houſe behind their Works; made there by two Tunnels under their Panns, carried back for that purpoſe. The Leach-brine, that runs from the Barrows, they put into the next Boyling, for 'tis to their advantage, being ſalt melted, and wanting only hardning.

This work is perform'd in 2. hours in the ſmaller panns, which are ſhallower, and generally boyle their brine more away; wherefore their Salt will laſt better, though it does not granulate ſo well, becauſe, when the Brine is waſted, the fire and ſtirring breaks the Cornes. But this Salt weighs heavier, and melts not ſo ſoon; and therefore is bought by them, that carry it farr. But in the greater Panns, which are uſually deeper, they are above halfe an hour longer in boyling; but, becauſe they take their Salt out of their Brine, and only harden it in their Hot-houſe, 'tis apter to melt away in a moiſt Air: Yet of this ſort of Salt the bigger the grain is, the longer it endures; and generally this is the better granulated and the clearer, though the other be the whiter. Vpon which I rather think, 'tis the taking of the ſalt out of the Brine before it be waſted, that cauſes the granulating of it, than the Ale to which the Workmen impute it. This kind meaſures profitably well; therefore much bought by them that buy to ſell again.

They never cover their Panns at all, during the whole time of Boyling. They have their Houſes like Barns open up to the thatch with a Cover-hole or two, to vent the ſteam of the panns. Poſſibly Tiles may do better, but no body is yet ſo curious as to try, but the ſteam is ſuch, that I am confident, no plaifter will ſtick, and boards will warp, and their nailes will ruſt ſo, as quickly to fret in pieces.

7. *Whether the Salt, made of theſe Springs be more or leſs apt to diſſolve in the Air, then other Salt? And whether it be as good to powder Beef or other Fleſh with, as French Salt?* This Queſtion I cannot well answer, in regard that French Salt comes not to us, to compare the efficacy of the one with the other experimentally; but this I can aſſure for our Salt, that with it both Beef and Bacon is very well preſerv'd ſweet and good a whole year together; and I do apprehend this Salt to be rather more ſearching than French Salt

Salt, because I have often observed, that meat kept with this Salt shall be more fiery Salt to the midst of it, than I have observed, when I have eaten powder'd meat on Ship-board, which was probably done with *French Salt*, I then being on the South-side of England, and in a Dutch Vessel. 'Tis certain, *Cheshire* sends yearly much Bacon to *London*, which never yet had any mark of infamy set upon it; and hanged Beef (which others call *Martin-mass-Beef*) is as good and as frequent in *Cheshire*, as in any place; so that I conclude, that this Salt is fully effectual for any Use, and as good as any other; and therefore hope, 'twill be prosecuted in the use, that so the Trade of our own Commodities may rather be advanced, than of forraign, especially this of Salt; which if it shall please the *R. Society* to promote, they will lay an obligation on all our Country never to be forgotten.

Mean time, if I have related here any thing obscurely or imperfectly, I am ready to answer any new Queries, that shall arise out of this obscurity, or give larger satisfaction to any of the Old, that shall be thought hereby not sufficiently explained.

Explication of the Figures belonging to the Accompt of Salt-making.

Fig. 1.

This is the Model of an Iron-pann of that proportion, when Four are used in one house.

a a. The Eares to hang the Pann by upon the Brick work.

b. The several Junctures of the Iron plates riveted.

C C. The breadth and length of the Pann near 4. foot.

C d. The depth of the sides of the Pann, about 6. inches.

Fig. 2.

a a. The Hot-house between the Wall and the Chimney.

b b. The two Tunnels.

C C. The Chimney-back, into which the two Tunnels convey the smoak.

d d d. The four Panns.

E. The partition-wall between the Panns and the Hot-house.

f. The Fire-places.

g. The Ash-holes.

h. The Hearth below.

ii. The descent to the Hearth.

Fig. 3.

The Pack with his stale, with which they reach brine out of their Ship to fill their Panns withall.

Fig. 4.

a b. Several positions of their Loots, with which they skim, and gather their Salt.

Fig. 5-

a a. Two Barrows newly filled with Salt; set into the Leach-trough to dripp out the Leach or Leack-brine,

b b. The Salt heaped above the Barrows and patted down hard.

C. The Leach trough.

Fig. 6.

A gutter, which they lay over from one Pann to another, to poure the Brine into the farthest pann.

